ACCESSION #: 9704230234
NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Diablo Canyon Unit 1 PAGE: 1 OF 7

DOCKET NUMBER: 05000275

TITLE: Reactor Trip on Units and 2 Due to Major Western Grid Disturbance

EVENT DATE: 08/10/96 LER #: 96-012-01 REPORT DATE: 4/17/97

OTHER FACILITIES INVOLVED: Diablo Canyon Unit 2 DOCKET NO: 05000323

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On August 10, 1996, at 1549 PDT, with Units 1 and 2 in Mode 1 (Power Operation) at 100 percent power, a major disturbance on the western transmission grid resulted in reactor trips on both units. Both units were stabilized in Mode 3 (Hot Standby) in accordance with plant emergency procedures. A 4-hour, non-emergency report was made to the NRC at 1842 PDT in accordance with 10 CFR 50.72 (b)(2)(ii).

Undervoltage and underfrequency conditions were experienced on both the auxiliary and startup systems due to a disturbance on the 500 kV system external to the PG&E system. Unit 1 experienced a reactor trip due to a 12 kV auxiliary power system reactor coolant pump (RCP) feeder bus undervoltage and Unit 2 experienced a reactor trip due to two of four RCP breakers open.

The Unit 1 RCPs and the circulating water pumps remained running throughout the event. Since the Unit 2 RCPs were not running, control room operators closed the Unit 2 main steam isolation valves to prevent excessive cooldown. One RCP was restarted 69 minutes after the pumps tripped off the line; thus Unit 2 was on natural circulation for 69 minutes.

The Western System Coordinating Council study of the transient did not provide any recommendations applicable to Diablo Canyon Power Plant. PG&E determined that no additional corrective actions were necessary.

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I. Plant Conditions

Units 1 and 2 were in Mode 1 (Power Operation) at 100 percent power.

II. Description of Problem

A. Summary:

On August 10, 1996, at 1549 PDT, with Units 1 and 2 in Mode 1 at 100 percent power, Unit 1 experienced a reactor trip [AB][RCT] due to a 12 kV auxiliary power system (reactor coolant pump (RCP) [AB][P] feeder bus [EA][BU]) undervoltage and Unit 2 experienced a reactor trip due to two of four RCP breakers being open. The units were stabilized in Mode 3 (Hot Standby) in accordance with plant emergency procedures. A 4-hour, non-emergency report was made at 1842 PDT in accordance with 10 CFR 50.72(b)(2)(ii).

B. Background:

PG&E has transmission systems operating at several voltage levels. The Diablo Canyon Power Plant (DCPP) is connected to the 230 kV system [FK] for startup and standby power, and to the 500 kV system [FK] for transmission of the plant's power output. The 500 kV system is further connected through the 500 kV Pacific Intertie to the Western Systems Coordinating Council (WSCC) network covering the eleven western states and British Columbia.

The DCPP electrical systems generate and transmit power to the high-voltage (500 kV) system; distribute power to the auxiliary loads; and provide control, protection, instrumentation, and annunciation power supplies for the units.

Final Safety Analysis Report (FSAR) Update Section 15.3.4, "Complete Loss of Forced Reactor Coolant Flow," states that a reactor trip on RCP bus undervoltage is provided to protect against conditions that can cause a loss of voltage to all RCPs, i.e., loss of offsite power. In addition, a reactor trip on low primary coolant loop flow is provided to protect against loss of flow conditions that affect only one RCP and also serves as a backup to the undervoltage trip.

The 12 kV system is designed with undervoltage, underfrequency, and RCP breaker position inputs to the plant protection system (PPS). The PPS trips the reactor. These trips are used to prevent the core from exceeding departure from nucleate boiling limits when there is not enough coolant flow to remove the heat generated by the fuel. The undervoltage and underfrequency reactor trips are required by FSAR Chapter 15 for a complete loss of flow accident. The RCP breaker open trip is a backup for the underfrequency and undervoltage protection features since the underfrequency and undervoltage protection sensors would not immediately detect a loss of power to the RCP if the RCP breakers were to open.

C. Event Description:

On August 10, 1996, at 1549 PDT, with Units 1 and 2 in Mode 1 at 100 percent power, undervoltage and underfrequency conditions were experienced on both the auxiliary and startup systems due to a disturbance on the 500 kV system external to the PG&E system. Unit 1 experienced a reactor trip due to a 12 kV auxiliary power system RCP feeder bus undervoltage.

Unit 2 experienced a reactor trip due to two of four RCP breakers being open. The units were stabilized in Mode 3 in accordance with plant emergency procedures. A 4-hour, non-emergency report was made to the NRC at 1842 PDT in accordance with 10 CFR 50.72(b)(2)(ii).

The Unit 1 RCPs and a circulating water pump remained running throughout the event. One main steam safety valve (MSSV) lifted low.

Unit 2 control room operators closed the Unit 2 main steam isolation valves (MSIVs) to prevent excessive cooldown. One RCP was restarted 69 minutes after the pumps tripped off the line; thus Unit 2 was on natural circulation for 69 minutes.

Both units transferred to startup power (230 kV) as per design. The 500 kV offsite power was declared inoperable due to voltage and frequency fluctuations. The 230 kV offsite power was determined to be inoperable due to all units at Morro Bay Power Plant being offline following the system disturbance.

Based on reports of an extended power outage in the surrounding areas, PG&E initiated an investigation of the offsite emergency warning sirens availability. Personnel were sent to the Emergency Operating Facility to

confirm the status of the sirens. On August 10, 1996, at approximately 1845 PDT, PG&E verified that approximately 100 of 130 of the offsite emergency warning sirens were without power. A 1-hour non-emergency report for the loss of sirens was made to the NRC in accordance with 10 CFR 50.72 (b)(1)(v) at 2045 PDT. The 1-hour report was late due to higher priority actions being performed to stabilize both units in Mode 3 and maintain them in a safe shutdown condition. At 2200 PDT, approximately 90 percent of the sirens were verified to be operable. On August 11, 1996, at 0100 PDT, all of the sirens except three were verified to be operable.

D. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

E. Dates and Approximate Times for Major Occurrences:

August 10, 1996, at 1549 PDT: Event date/discovery date. Units 1 and 2 reactor trips.

August 10, 1996, at 1842 PDT: A 4-hour non-emergency report made in accordance with 10 CFR 50.72 (b)(2)(ii) for the Units 1 and 2 reactor trips.

August 10, 1996, at 2045 PDT: A 1-hour non-emergency report was made in accordance with 10 CFR
50.72 (b)(1)(v), due to the loss
of sirens.

F. Other Systems or Secondary Functions Affected:

None.

G. Method of Discovery:

The event was immediately apparent to plant operators due to alarms and indications received in the control room.

H. Operator Actions:

Licensed plant operators in the control room responded in accordance with established emergency procedures, confirmed the reactor trips, verified proper engineered safety feature actuations, and initiated manual actions to stabilize the units in Mode 3.

Operators closed the MSIVs on Unit 2 to prevent an excessive cooldown.

I. Safety System Responses:

1. The reactor trip breakers (JC)(BKR) opened.

2. The main turbine [TA][TRB] tripped (turbine stop valves closed).

3. The control rod drive mechanism [AA][DRIV] allowed the control rods to drop into the core.

4. The motor-driven auxiliary feedwater (AFW) pumps and the turbine-driven AFW pump started automatically and delivered water to all steam generators as required.

5. Containment Fan Cooler Units (CFCUs) 1-2, 1-4, and 1-5 and CFCUs 2-1, 2-2, and 2-5 started. CFCUs 2-3 and 2-4

tripped on thermal overload when they attempted to restart in high speed. CFCUs 1-1 and 1-3 were inoperable prior to this event. The CFCUs 2-3 and 2-4 restart problems were attributed to an improper system alignment, which was corrected, and the CFCUs were returned to service.

6. One Unit 1 and two Unit 2 MSSVs lifted below their expected setpoints. This event was reported in LER 1-96-013.

III. Cause of the Problem

A. Immediate Cause:

Unit 1 experienced a reactor trip due to a 12 kV auxiliary power system RCP feeder bus undervoltage and Unit 2 experienced a reactor trip due to two of four RCP breakers open.

B. Root Cause:

The event was due to a 500 kV system disturbance due to a transmission line fault external to the PG&E system.

IV. Analysis of the Event

A reactor trip from 100 percent power is a previously analyzed FSAR Update, Chapter 15, Condition II event. The reactor protection systems (RPS) responded as designed and initiated reactor trips on low RCP bus voltage for Unit 1 and two of four RCP breakers open for Unit 2. The units were stabilized in Mode 3 in accordance with approved plant procedures.

After review of previous reactor trip data, PG&E determined that the plant cooldowns were consistent with several past unit trips.

Thus, the health and safety of the public were not affected by this event.

V. Corrective Actions

A. Immediate Corrective Actions:

Electrical equipment inspections were performed before allowing the plant to restart. No adverse conditions were found.

B. Corrective Actions to Prevent Recurrence:

The Western System Coordinating Council study of the transient did not provide any recommendations specifically applicable to Diablo Canyon Power Plant.

VI. Additional Information

A. Failed Components:

None.

B. Previous LERs on Similar Problems:

LER 1-94-020-00, "Reactor Trip Due to Reactor Coolant Pump Bus Undervoltage That Resulted From an Electrical System Disturbance External to the PG&E System." On December 14, 1994, at 0026 PST, with Units 1 and 2 in Mode 1 at 100 percent power, both units experienced reactor trips due to a 12 kV auxiliary power system RCP feeder bus undervoltage. The units were stabilized in Mode 3 in accordance with plant emergency procedures. The RCP undervoltage and underfrequency trip setpoint time delays were increased to the maximum allowed by the TS. The time delays did not prevent the current event since the degraded conditions existed for a time longer than the delays. Therefore, increasing the time delays to the TS maximum could not have prevented the current event.

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